

Обмін досвідом

УДК 616.718.42-001-08:612.391:546.23

P.E. Kovalchuk, S.V. Tulyulyuk

EXPERIENCE OF THE FEMORAL NECK FRACTURES' TREATMENT IN SELENIUM DEFICIENCY REGION' PATIENTS

Higher State Educational Institution of Ukraine «Bukovinian State Medical University» (Chernivtsi)

Abstract. This article presents an analysis of surgical treatment of the femoral neck fractures in patients in the region with selenium deficiency.

Selenium is the most controversial trace element among other minerals. It has a very limited range between essential and toxic dose.

The basis of this research is the studying of the results of surgical treatment of 28 patients aged between 40 and 75 years with closed fractures of the femoral neck, who were

treated during 2014-2015 in the traumatological department for adults in the hospital of emergency medical services in Chernivtsi. Osteosynthesis of femoral neck was performed for patients. All 28 (100%) patients had verified selenium deficient condition and this fact indicated a possible secondary osteopenia or osteoporosis.

Key words: selenium, osteogenesis, femoral neck, deficiency, osteoporosis, surgical treatment.

Introduction. Selenium is the most controversial trace element among other minerals. It has a very limited range between essential and toxic dose. The physiological need of selenium for adult men is 70 micrograms and 55 micrograms for women. A higher level, almost 200 micrograms is required during pregnancy and lactation period. There are a lot of transformations of selenium after it gets into the human body. Trace element affects the functioning of the body bursting into specific selenium proteins. Currently, there are near 25 selenium proteins and more than 35 proteins which include selenium [4].

Glutathione peroxidase family is distinguished among the specific selenium proteins (GPX) – 6 enzymes, thioredoxin reductases (TR) – 3 enzymes, iodonitronin deiodinase (D) – 3 forms, selenium protein P (the only protein that contains more than one atom of selenium and is a major source of extracellular selenium, one of the markers of nutritional supply of selenium), selenium protein W, selenosulphates synthetase and a lot of other selenium proteins the functions of which have not been found yet [2].

Assumption that selenium deficiency is one of the factors of the development and progression of tyreopathy is noteworthy nowadays. Almost all the continental states including Ukraine are selenium deficiency countries. Especially there is a little amount of Se in the soils and plants in Vinnytsia, Volyn, Kyiv, Luhansk, Odesa, Poltava, Ternopil, Khmelnytsky, Chernivtsi, Kharkiv, Chernihiv, Sumy regions and in Crimea [3].

The thyroid gland has particularly high need in selenium and belongs to organs with the highest level of this element per 1g of tissue. Selenium, like iodine, is necessary for normal thyroid function, thyroid homeostasis. It was found that all three deiodinases, that convert T₄ to T₃, contain selenocystein. It shows that the production of active thyroid hormone depends on the selenium status. Selenium iodine and thyroxine deiodinases (Ds) present in most tissues

and provide a mechanism, which regulate an activation of thyroid hormones [7].

As well as other functions, selenium is closely related to metabolism of iodine in the body. It shows that all biogeochemical regions with a lack of iodine, including Chernivtsi region, have selenium deficiency [1].

The problem of healing bone fractures is one of the actual in traumatology. Examining factors affecting bone formation is one of the approaches to its solution [5, 6].

The aim of the research is to promulgate the results of analysis of surgical treatment of the femoral neck fractures in patients residing in the region with selenium deficiency.

Materials and Methods. The basis of this research is the studying of the results of surgical treatment of 28 patients between 40 and 75 years with closed fractures of the femoral neck, who were being treated during 2014-2015 in the traumatological department for adults in the emergency hospital in Chernivtsi. Osteosynthesis of femoral neck was performed for all patients. All 28 (100 %) patients had verified selenium deficient condition and this fact indicated a possible secondary osteopenia or osteoporosis.

Determination of selenium in blood plasma of patients was performed by fluorimetric method on spectrofluorimeter SFM25 ("Kontron Instruments", USA).

Results of experiments were analyzed by variational statistics method using parametric Student criterion.

Determination of selenium in the blood plasma of the examined groups of the patients allowed to expose that the average value of selenium of the blood plasma is 78,3±5,1 mg/l, which is below the optimal value (115-130 mg / l) and shows the light degree of selenium deficiency (table).

X-ray densitometry was performed for all patients for the purpose of diagnosis of secondary os-

Table

Selenium degree deficiency depending on the amount of Se, mg/l

Selenium degree deficiency	Se, mg / l	Number of the patients
Strong deficiency	<70	—
Light degree	70-90	28
Suboptimal degree	90-115	—
Optimal degree	115-130	—
Above the optimal physiological need	>130	—
Total		28

teoporosis (DEXA). Based on the data of densitometry in 27 (96,4 %) patients, mineral density of bone in the femoral neck and lumbar vertebrae (L1-L4) had osteoporosis, and in 1 (3,6 %) patient, osteopenia. The normal high bone mass (T-criteria) in terms of standard deviations (SD) was <-2,5 SD in patients with osteoporosis, and in patients with osteopenia – in the range from -1 to -2,5 SD.

According to the classification of Garden, there were observed 3 fractures (10,7 %) of the 1st type, 2 fractures (7,1 %) of the 2nd type, 16 fractures (57,1 %) of the 3rd type, and 7 fractures (24,9 %) of the 4th type. Therefore, the majority (82 %) was consisted by patients with fractures of the 3rd and 4th types which were accompanied by disorders of blood circulation in the head of the femur and were prognostically negative.

Osteosynthesis was performed by special braces: three spongy cannulated screws with a diameter of 6,5 mm were used for 16 (57,1 %) patients, dynamic hip screws (DHS) were used for 5 (17,8 %) patients; three spongy non-cannulated screws with a diameter of 6,5 mm were used for 2 (7,1 %) patients; three paddles nails of diaphyseal plate were used for 4 (14,2 %) patients and for 1 (3,5 %) patient – nails without diaphyseal plate.

Three (10,7 %) patients from the examined group of the patients were operated up to 24 hours after injuries, 13 (46,4 %) patients were operated on the 2nd-5th day after injuries, 11 (39,2 %) patients got surgery on the 6th-12th day and only 1 (3,5 %) patient was operated more than after 12 days after an injury.

The minimum time since the injury to surgery was 21 hours, the maximum – 16 days, the average number 5,86±1,63 days.

Selenium-active (1 tablet contains 50 micrograms of selenium, and 50 mg of vitamin C, duration of treatment is 1 month) was prescribed to all 28 (100 %) patients, for the elimination selenium deficiency and for the prevention of further development of osteoporosis. In addition, some recommendations to the patients' diet were given: to eat products with higher selenium content during the period of illness and recuperation.

Results and discussion of the research. We studied the concentration of selenium in blood plasma in 28 (100 %) patients during a year and a half. Average level of selenium was 91,4±6,8 mg / l

in 12 (42,8 %) patients, which shows a light degree of selenium deficiency (tab. 1), and 16 (57,2 %) patients had 119 2±3,4 mg/l – an optimal degree of selenium in blood plasma.

X-ray densitometry was performed for all patients for the determination of state of bone tissue density and for the purpose of diagnosis of secondary osteoporosis (DEXA). According to the data of densitometry in 28 (100 %) patients mineral density of bone in the femoral neck and lumbar vertebrae (L1-L4) was osteopenia (-1 < T criteria < -2,5).

The results of osteosynthesis were being examined during the year and a half. Healing of fractures without complications was observed in 16 (57,1 %) operated patients. Osteosynthesis was performed by three spongy cannulated screws in 12 patients – 75 % of all patients where such braces were applied. Using DHS fractures were fused in 2 patients (40%), consolidation took place in 2 patients (100%) using large spongy screws. Fusion was not observed in those patients for whom osteosynthesis had been made by nails of diaphyseal plate and nails without diaphyseal plate. The average periods of fusion in patients under 50 years were 24,6±1,8 weeks, at the age of 51-60 years – 25,3±1,8 weeks, at the age of 60-77 years – 25,1±2,5 weeks. Some complications were found in 12 patients (42,9 %). Nonunion with osteolysis of heads was found in 4 (25 %) patients, for one patient osteosynthesis was performed by cannulated screws, for two patients osteosynthesis was performed by three paddles nails of diaphyseal plate, for one – by three paddles nail. Aseptic necrosis with the development of difficult post-traumatic arthrosis was found in 4 (14,2 %) patients, for 3 of them osteosynthesis was performed using DHS, and for 1 patient (67,5 %) using cannulated screws.

Conclusions

1. The main reason of the femoral neck fractures in region with selenium deficiency is secondary osteoporosis; worsening of results of surgical treatment and a slowdown in terms of consolidation of fractures without adequate medical therapy for osteoporosis and elimination of selenium deficiency are possible.

2. Deficiency of selenium requires the use of pharmaceutical correction that is needed both in acute and posttraumatic periods.

Perspectives of further research is in study of selenium application efficacy in patients with femoral fractures.

References

1. Голубкина Н.А. Микроэлементы в медицине / Н.А. Голубкина, О.А. Сенькевич, Ю.Г. Ковальський: материалы II съезда Рос. общества элементологии (24-27 ноября 2008 г, Тверь, Россия). – Т. 9, вып. 12. Спец. выпуск. – С. 9-10.
2. Бабенко Г.А. Микроэлементозы человека: патогенез, профилактика, лечение / Г.А. Бабенко // Микроэлементы в медицине. – 2001. – Т. 2 (1). – С. 2-5.
3. Ковальчук П.Є. Морфологічні особливості репаративного остеогенезу в умовах селенодефіциту / П.Є. Ковальчук, С.В. Тулюлюк, С.В. Козлов // Бук. мед. вісник. – 2014. – Т. 18, № 4 (72). – С. 49-51.
4. Микроэлементозы человека: Этиология, классификация, органопатология / [А.Н. Авцын, Л.Л. Жаворонков, М.А. Риш и др.]. – М., 1991. – 348 с.
5. Тулюлюк С.В. Вміст селену в біологічних рідинах організму пацієнтів із поєднаною травмою, які проживають в селенодефіцитному регіоні / С.В. Тулюлюк // Міжнар. ендокринол. ж. – 2014. – № 6 (68). – С. 24-26.
6. Holmgren A. Selenoproteins of the thioredoxin system / A. Holmgren // Selenium. Its Molecular Biology and Role in Human Health / Ed. by D. L. Hatfield. – Boston, 2001. – P. 189-205.
7. Selenoproteins in human thyroid tissues / P. Zagrodzki, F. Nicol, J.R. Arthur, M. Slowiaczek // Biofactors. – 2001. – Vol. 14. – P. 223-227.

ОПЫТ ЛЕЧЕНИЯ ПЕРЕЛОМОВ ШЕЙКИ БЕДРЕННОЙ КОСТИ У БОЛЬНЫХ В СЕЛЕНОДЕФИЦИТНОМ РЕГИОНЕ

П.Е. Ковальчук, С.В. Тулюлюк

Резюме. В данной работе представлены результаты анализа оперативного лечения переломов шейки бедренной кости у пациентов в селенодефицитном регионе.

Среди множества минералов селен занимает особое место как наиболее противоречивый микроэлемент. Он имеет очень узкий диапазон между эссенциальной дозой и токсичной.

В основу данного исследования положен анализ результатов хирургического лечения 28 пациентов, в возрасте от 40 до 75 лет с закрытыми переломами шейки бедренной кости (ПШБК), находившихся на лечении с 2014 по 2015 год в травматологическом отделении для взрослых БСМП г. Черновцы, где им проведен остеосинтез шейки бедренной кости. У всех 28 (100 %) пациентов верифицирован селенодефицит, что свидетельствует о вероятной остеопении или вторичном остеопорозе.

Ключевые слова: селен, остеогенез, бедренная кость, дефицит, остеопороз, хирургическое лечение.

ДОСВІД ЛІКУВАННЯ ПЕРЕЛОМІВ ШИЙКИ СТЕГНОВОЇ КІСТКИ У ПАЦІЄНТІВ У СЕЛЕНОДЕФІЦИТНОМУ РЕГІОНІ

П.Є. Ковальчук, С.В. Тулюлюк

Резюме. У даній роботі представлені результати аналізу оперативного лікування переломів шийки стегнової кістки в пацієнтів у селенодефіцитному регіоні.

Серед безліч мінералів селен посідає особливе місце як найбільш суперечливий мікроелемент. Він має дуже вузький діапазон між есенційною дозою і токсичною.

В основу даного дослідження покладено аналіз результатів хірургічного лікування 28 пацієнтів віком від 40 до 75 років із закритими переломами шийки стегнової кістки (ПШСК), що перебували на лікуванні з 2014 по 2015 рік у травматологічному відділенні для дорослих ЛШМД м. Чернівці, де їм проведено остеосинтез шийки стегнової кістки. У всіх 28 (100 %) пацієнтів верифіковано селенодефіцитний стан, що свідчить про ймовірну остеопенію чи вторинний остеопороз.

Ключові слова: селен, остеогенез, стегнова кістка, дефіцит, остеопороз, хірургічне лікування.

Вищий державний навчальний заклад України
«Буковинський державний медичний університет» (м. Чернівці)

Рецензент – проф. Р.І. Сидорчук

Buk. Med. Herald. – 2016. – Vol. 20, № 3 (79). – P. 245-247

Надійшла до редакції 13.07.2016 року